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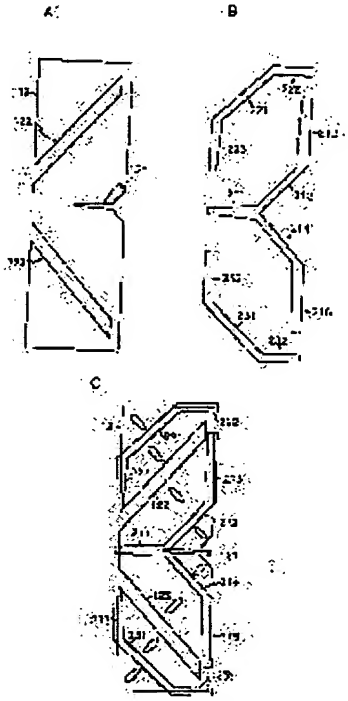
(54) WIDE VISUAL FIELD ANGLE LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a liquid crystal display device which is wide in a wide visual field angle, is stable in the alignment of liquid crystal molecules and is high in a response rate.

SOLUTION: This liquid crystal display device is formed with apertures of upper and lower plates as parallel as possible while the design rule thereof is abode by. More specifically, the first opening patterns and second opening patterns of the liquid crystal display device including pixel electrodes 12 which is formed on a first substrate 10 and have the first opening patterns, common electrodes 13 which are formed on the under surface of an insulating second substrate 20 facing the first substrate 10 and have the second opening patterns 20 and liquid crystal materials which are injected between the first substrate 10 and the second substrate 20 are formed to a straight shape in the central parts and are parallel to each other. The first opening patterns and the second opening pattern are arranged alternately with each other.



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* NOTICES *

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The 1st substrate of an insulation. It is formed on the 1st substrate of the above, and is the 1st opening pattern. It is the liquid crystal display equipped with the above, and the center section is formed in linear and, as for the aforementioned 1st opening pattern and the aforementioned 2nd opening pattern, is characterized by being arranged by turns in parallel and mutually mutually.
[Claim 2] The liquid crystal display according to claim 1 characterized by providing the following. The aforementioned 1st opening pattern is the 1st opening currently formed in the up field of the aforementioned pixel electrode in the 1st direction. The aforementioned 2nd opening pattern is the 1st trunk opening currently formed in the up field of the aforementioned pixel electrode, and the corresponding position in the 1st direction of the above including the 2nd opening currently formed in the 1st direction of the above, and the 2nd direction which makes a perpendicular to the lower field of the aforementioned pixel electrode. The 2nd trunk opening currently formed in the lower field of the aforementioned pixel electrode, and the corresponding position in the 2nd direction of the above.
[Claim 3] The 1st direction of the above is a liquid crystal display according to claim 2 characterized by being the direction of a slash to the side of the aforementioned pixel electrode.
[Claim 4] The 1st branch opening which superimposes the aforementioned 2nd opening pattern on the vertical side of the aforementioned pixel electrode, Including the 2nd branch opening superimposed on the right-and-left side of the aforementioned pixel electrode, the aforementioned 1st opening pattern is located in the center of the upper and lower sides of the aforementioned pixel electrode, and contains the 3rd opening parallel to the vertical side of the aforementioned pixel electrode. The aforementioned 1st opening pattern and the aforementioned 2nd opening pattern are a liquid crystal display according to claim 3 characterized by dividing the aforementioned pixel electrode into the polygon which a large number closed.
[Claim 5] The aforementioned 2nd branch opening is a liquid crystal display according to claim 4 characterized by width of face being wider than the aforementioned trunk opening.
[Claim 6] The 1st direction of the above is a liquid crystal display according to claim 2 characterized by being a direction parallel to any one of the sides of the aforementioned pixel electrode.
[Claim 7] the [the above 1st and] -- the liquid crystal display according to claim 6 with which width of face is gradually characterized by the bird clapper widely, so that the ends of 2 trunk opening go to an edge
[Claim 8] One of the aforementioned 2nd trunk openings is the liquid crystal display according to claim 6 characterized by superimposing on the lower side of the aforementioned pixel electrode.
[Claim 9] The edge of the 1st opening of the above is a liquid crystal display according to claim 6 with which width of face is gradually characterized by the bird clapper narrowly, so that it goes to an edge.
[Claim 10] The polarization direction of the above 1st and the 2nd polarizing plate is a liquid crystal display according to claim 2 characterized by making 45 degrees with the above 1st and the 2nd direction, respectively, including further the 1st polarizing plate currently formed in the bottom of the 1st substrate of the above, and the 2nd polarizing plate currently formed on the 2nd substrate of the above.
[Claim 11] The liquid crystal display according to claim 10 which contains further the 1st compensation film to which the one inside in the above 1st and the 2nd polarizing plate adheres.
[Claim 12] The aforementioned 1st compensation film is a liquid crystal display according to claim 11 which is an optically-biaxial compensation film.
[Claim 13] Whether the direction which has the greatest refractive index in the aforementioned 1st compensation film is in agreement with the transparency shaft of the above 1st and the 2nd polarizing plate, and the liquid crystal display according to claim 12 which intersects perpendicularly.
[Claim 14] The liquid crystal display according to claim 11 which contains further the 2nd compensation film to which

the one inside in the above 1st and the 2nd polarizing plate adheres.
[Claim 15] the [the above 1st and] -- the liquid crystal display according to claim 14 whose 2 compensation films are a plate and c plate optically uniaxial compensation film, respectively
[Claim 16] Whether the direction which has the greatest refractive index in the aforementioned a plate optically uniaxial compensation film is in agreement with the transparency shaft of the above 1st and the 2nd polarizing plate, and the liquid crystal display according to claim 15 which intersects perpendicularly.
[Claim 17] The aforementioned pixel electrode is a liquid crystal display according to claim 2 characterized by having a lobe in the side contiguous to the terminal point of the above 1st and the 2nd opening.
[Claim 18] the [the above 1st and] -- the liquid crystal display according to claim 1 characterized by the range of the width of face of two opening patterns being 10 to 16 micrometers
[Claim 19] The 1st substrate of an insulation. It is formed on the 1st substrate of the above, and is the 1st opening pattern. It is the liquid crystal display equipped with the above, and the aforementioned 1st opening pattern and the aforementioned 2nd opening pattern are superimposed, the aforementioned pixel electrode is divided into many small fields, and the aforementioned smallness field is characterized by the two longest sides being parallel polygons mutually.
[Claim 20] The aforementioned smallness field is a liquid crystal display according to claim 19 which is divided into the 1st smallness field whose two longest sides are the 1st direction, and the 2nd smallness field whose two longest sides are the 2nd direction, and is characterized by the 1st direction of the above and the 2nd direction of the above making 90 degrees.
[Claim 21] The 1st direction of the above is a liquid crystal display according to claim 20 characterized by being the direction of a slash to the side of the aforementioned pixel electrode.
[Claim 22] The 1st direction of the above is a liquid crystal display according to claim 20 characterized by being parallel to one of the vertical side of the aforementioned pixel electrode, or the right-and-left sides.
[Claim 23] the [the above 1st and] -- the liquid crystal display according to claim 19 characterized by the range of the width of face of two opening patterns being 10 to 16 micrometers
[Claim 24] The 1st substrate of an insulation. It is formed on the 1st substrate of the above, and is the 1st opening pattern. the time of being the liquid crystal display equipped with the above, and voltage being impressed between the aforementioned pixel electrode and the aforementioned common electrode -- the [the above 1st and] -- the direction where orientation of the liquid crystal molecule of the aforementioned liquid crystal matter is carried out by the fringe field formed with two opening patterns is characterized by being in agreement with the direction as for which orientation is carried out by the force between the aforementioned liquid crystal molecules
[Claim 25] The direction of orientation of the aforementioned liquid crystal molecule by the aforementioned fringe field is a liquid crystal display according to claim 24 characterized by being divided in the four directions.
[Claim 26] the [the above 1st and] -- the liquid crystal display according to claim 24 characterized by the range of the width of face of two opening patterns being 10 to 16 micrometers
[Claim 27] The 1st substrate of an insulation, and the pixel electrode which is formed on the 1st substrate of the above and has the 1st opening pattern, The 1st substrate of the above, the 2nd substrate of an insulation which has countered, and the common electrode which is formed in the 2nd substrate of the above and has the 2nd opening pattern, The liquid crystal matter poured in between the 1st substrate of the above and the 2nd substrate of the above is included. the aforementioned 1st opening pattern It is formed in the 1st opening and the direction of; slash which are formed in the longitudinal direction from the 1st side of the aforementioned pixel electrode. It consists of the 2nd and 3rd openings to which the symmetry is mutually made to the 1st opening of the above, and an interval becomes large so mutually that the 1st aforementioned side is approached from the 1st aforementioned side and the 2nd side which counters, and;. The 1st and the 2nd branch which become far mutually, so that the aforementioned 2nd opening pattern is formed in the direction of a slash from the management currently formed in the longitudinal direction, and the aforementioned management, respectively and separates from the aforementioned management, The 4th opening and the 1st branch of; above including the 1st and the 2nd branch edge which are formed in lengthwise from the above 1st and the 2nd branch, and have been mutually extended to opposite direction, and the 1st parallel center section, It consists of the 5th opening of the above, the 6th opening which makes the symmetry, and; to the 5th opening containing 2 refraction sections, and the 4th opening of; above. the [the 1st currently formed in a longitudinal direction and lengthwise from the ends of the 1st center section of the above, respectively, and] -- the [the aforementioned 1st opening pattern and] -- the liquid crystal display characterized by locating two opening patterns by turns if a liquid crystal display is seen from a top
[Claim 28] The above 1st and the 2nd branch edge, and the aforementioned 2nd refraction section are a liquid crystal display according to claim 27 characterized by width of face being wider than other portions of the aforementioned 2nd

opening pattern.
[Claim 29] The polarization direction of the above 1st and the 2nd polarizing plate is a liquid crystal display according to claim 27 or 28 characterized by being a longitudinal direction and lengthwise or lengthwise, and a longitudinal direction, respectively, including further the 1st polarizing plate currently formed in the bottom of the 1st substrate of the above, and the 2nd polarizing plate currently formed on the 2nd substrate of the above.
[Claim 30] The width of face of the above 1st or the 6th opening is a liquid crystal display according to claim 27 or 28 characterized by being the range of 10 to 16 micrometers.
[Claim 31] the following -- having -- the [the aforementioned 1st opening pattern and] -- the liquid crystal display characterized by locating two opening patterns by turns if a liquid crystal display is seen from a top The 1st substrate of an insulation. The pixel electrode which is formed on the 1st substrate of the above and has the 1st opening pattern. The 1st substrate of the above, and the 2nd substrate of an insulation which has countered. It is formed in the 2nd substrate of the above, and the liquid crystal matter poured in between the common electrode which has the 2nd opening pattern, and the 1st substrate of the above and the 2nd substrate is included. the aforementioned 1st opening pattern The 1st slash section currently formed in the direction of a slash toward the 2nd side which counters this from the 1st side of the aforementioned pixel electrode, The 1st opening containing the 2nd slash section which is bent from the aforementioned 1st slash section and formed in the direction of a slash toward the 1st aforementioned side is included. the aforementioned 2nd opening pattern The 2nd opening containing the horizontal branch extended in the longitudinal direction from the center of the fundus currently formed in lengthwise, and the aforementioned fundus, the [the 1st extended in the direction of a slash, respectively from the ends of the center section currently formed in lengthwise, and the aforementioned center section, and] -- the 3rd opening which makes the symmetry to the 2nd opening of the above including 2 slash branch
[Claim 32] The polarization direction of the above 1st and the 2nd polarizing plate is a liquid crystal display according to claim 31 characterized by being a longitudinal direction and lengthwise or lengthwise, and a longitudinal direction, respectively, including further the 1st polarizing plate currently formed in the bottom of the 1st substrate of the above, and the 2nd polarizing plate currently formed on the 2nd substrate of the above.
[Claim 33] The width of face of the above 1st or the 3rd opening is a liquid crystal display according to claim 31 or 32 characterized by being the range of 10 to 16 micrometers.
[Claim 34] The angle of the both sides of a point which the aforementioned fundus and the aforementioned ramus-transversus section of the angle of the both sides of the 2nd side of the aforementioned pixel electrode and the 2nd opening of the above collide with is a liquid crystal display according to claim 31 or 32 with which chamfering is performed.
[Claim 35] The 1st substrate of an insulation, and the pixel electrode which is formed on the 1st substrate of the above and has the 1st opening pattern, The 1st substrate of the above, the 2nd substrate of an insulation which has countered, and the common electrode which is formed in the 2nd substrate of the above and has the 2nd opening pattern, The liquid crystal matter poured in between the 1st substrate of the above and the 2nd substrate is included. the aforementioned 1st opening pattern The 1st opening investigated toward the 2nd side which counters this from the 1st side of the aforementioned pixel electrode, The 2nd opening investigated [aforementioned] toward the 1st aforementioned side from the 2nd side is included. the aforementioned 2nd opening pattern The 1st slash section currently formed in the direction of a slash, and the 2nd slash section which was bent from the aforementioned 1st slash section and has been extended in the direction of a slash, The 3rd opening including the 3rd slash view which was bent from the aforementioned 2nd slash section and has been extended in the same direction as the aforementioned 1st slash section is included. The 3rd opening of the above is a liquid crystal display according to claim 35 characterized by dividing into two each field of the aforementioned pixel electrode classified into three fields by the above 1st and the 2nd opening, respectively.
[Claim 36] The polarization direction of the above 1st and the 2nd polarizing plate is a liquid crystal display according to claim 35 characterized by being 45 degrees and 135 degrees or 135 degrees, and 45 degrees, respectively when [a longitudinal direction] it is 0 degree, including further the 1st polarizing plate currently formed in the bottom of the 1st substrate of the above, and the 2nd polarizing plate currently formed on the 2nd substrate of the above.
[Claim 37] The width of face of the above 1st or the 3rd opening is a liquid crystal display according to claim 35 or 36 characterized by being the range of 10 to 16 micrometers.
[Claim 38] Two angles which are not superimposed on the angle of the both sides of the entrance of the above 1st and the 2nd opening and the 3rd opening of the above of the aforementioned pixel electrode are liquid crystal displays according to claim 35 or 36 with which chamfering is performed.
[Claim 39] The liquid crystal matter poured in between a common electrode, and the 1st substrate of the above and the 2nd substrate which are characterized by providing the following is included. The aforementioned 1st opening pattern

consists of linear opening of a large number which set a fixed interval to the aforementioned pixel electrode, and are formed in the longitudinal direction. The aforementioned 2nd opening pattern is a liquid crystal display characterized by the aforementioned 2nd opening pattern quadrisecting each field of the aforementioned pixel electrode which consists of X typeface opening of a large number which set a fixed interval and are formed, and is classified into many fields with the aforementioned 1st opening pattern. The 1st substrate of an insulation. The pixel electrode which is formed on the 1st substrate of the above and has the 1st opening pattern. The 1st substrate of the above, and the 2nd substrate of an insulation which has countered. It is formed in the 2nd substrate of the above, and is the 2nd opening pattern.

[Claim 40] The polarization direction of the above 1st and the 2nd polarizing plate is a liquid crystal display according to claim 39 characterized by being 45 degrees and 135 degrees or 135 degrees, and 45 degrees, respectively when [a longitudinal direction] it is 0 degree, including further the 1st polarizing plate currently formed in the bottom of the 1st substrate of the above, and the 2nd polarizing plate currently formed on the 2nd substrate of the above.

[Claim 41] The width of face of the aforementioned linear opening and X typeface opening is a liquid crystal display according to claim 39 or 40 characterized by being the range of 10 to 16 micrometers.

[Claim 42] The liquid crystal matter poured in between a common electrode, and the 1st substrate of the above and the 2nd substrate which are characterized by providing the following is included. the aforementioned 1st opening pattern The 1st opening which divides the upper surface of the aforementioned pixel electrode perpendicularly, and the 2nd opening which is located under the 1st opening of the above and divides the aforementioned pixel electrode horizontally are included. the aforementioned 2nd opening pattern The 3rd opening currently formed in lengthwise and the 4th opening currently formed in the bottom of the 3rd opening of the above at the longitudinal direction are included. The 1st opening of the above and the 3rd opening of the above are a liquid crystal display which is located by turns, divides the upper surface of the aforementioned pixel electrode into many fields perpendicularly, and is characterized by locating the 2nd opening of the above, and the 4th opening of the above by turns, and dividing the inferior surface of tongue of the aforementioned pixel electrode into many fields horizontally. The 1st substrate of an insulation. The pixel electrode which is formed on the 1st substrate of the above and has the 1st opening pattern. The 1st substrate of the above, and the 2nd substrate of an insulation which has countered. It is formed in the 2nd substrate of the above, and is the 2nd opening pattern.

[Claim 43] What is located in the bottom among the 4th opening of the above is a liquid crystal display according to claim 42 characterized by superimposing on the lower side of the aforementioned pixel electrode.

[Claim 44] The 4th opening of the above is a liquid crystal display according to claim 42 characterized by width of face increasing gradually in both ends.

[Claim 45] The soffit section of the 1st opening of the above is a liquid crystal display according to claim 42 with which width of face is gradually characterized by the bird clapper narrowly.

[Claim 46] The polarization direction of the above 1st and the 2nd polarizing plate is a liquid crystal display according to claim 42 characterized by being 45 degrees and 135 degrees or 135 degrees, and 45 degrees, respectively when [a longitudinal direction] it is 0 degree, including further the 1st polarizing plate currently formed in the bottom of the 1st substrate of the above, and the 2nd polarizing plate currently formed on the 2nd substrate of the above.

[Claim 47] The width of face of the above 1st or the 4th opening is a liquid crystal display according to claim 42 characterized by being the range of 10 to 16 micrometers.

[Claim 48] The liquid crystal matter poured in between a common electrode, and the 1st substrate of the above and the 2nd substrate which are characterized by providing the following is included. The 2nd opening by which the aforementioned 2nd opening pattern is formed in lengthwise including the 1st linear opening by which the aforementioned 1st opening pattern is formed in the lower part of the aforementioned pixel electrode at the longitudinal direction, If a liquid crystal display is seen from a top including the 3rd opening which is located under the 2nd opening of the above and is formed in the longitudinal direction The liquid crystal display which the upper surface of a pixel electrode is made right and left by the 2nd opening of the above for 2 minutes, and is characterized by dividing the undersurface of the aforementioned pixel electrode into many fields by the above 1st and the 3rd opening. The 1st substrate of an insulation. The pixel electrode which is formed on the 1st substrate of the above and has the 1st opening pattern. The 1st substrate of the above, and the 2nd substrate of an insulation which has countered. It is formed in the 2nd substrate of the above, and is the 2nd opening pattern.

[Claim 49] The upper-limit section of the 2nd opening of the above and the both ends of the 3rd opening of the above are a liquid crystal display according to claim 48 characterized by width of face increasing gradually.

[Claim 50] What is located in the bottom among the 3rd opening of the above is a liquid crystal display according to claim 48 characterized by superimposing on the lower side of the aforementioned pixel electrode.

[Claim 51] The polarization direction of the above 1st and the 2nd polarizing plate is a liquid crystal display according

to claim 48 characterized by being 45 degrees and 135 degrees or 135 degrees, and 45 degrees, respectively when [a longitudinal direction] it is 0 degree, including further the 1st polarizing plate currently formed in the bottom of the 1st substrate of the above, and the 2nd polarizing plate currently formed on the 2nd substrate of the above.
[Claim 52] The width of face of the above 1st or the 3rd opening is a liquid crystal display according to claim 48 characterized by being the range of 10 to 16 micrometers.
[Claim 53] The liquid crystal matter poured in between a common electrode, and the 1st substrate of the above and the 2nd substrate which are characterized by providing the following is included. the aforementioned opening pattern The 1st opening of the rhombus of a large number which set a fixed interval and are arranged by the single tier, The side facing the 1st opening of the above has the shape of tooth form of the saw by which the valley was curve-ized. Are making the bilateral symmetry to the 1st opening of the above, and if a liquid crystal display is seen from a top including the 2nd located between the 1st opening of the above, and 3rd openings, the mountain portion of the gear tooth of the aforementioned saw It is the liquid crystal display which the 1st opening of the above is located in the center of each ellipse which makes the aforementioned pixel electrode, and is characterized by the above 2nd and the 3rd opening having surrounded the pixel electrode. The 1st substrate of an insulation. The pixel electrode of the form by which it is formed on the 1st substrate of the above, and many ellipses are connected with the single tier. The 1st substrate of the above, and the 2nd substrate of an insulation which has countered. It is formed in the 2nd substrate of the above, and is an opening pattern.
[Claim 54] The polarization direction of the above 1st and the 2nd polarizing plate is a liquid crystal display according to claim 53 characterized by being a longitudinal direction and lengthwise or lengthwise, and a longitudinal direction, respectively, including further the 1st polarizing plate currently formed in the bottom of the 1st substrate of the above, and the 2nd polarizing plate currently formed on the 2nd substrate of the above.
[Claim 55] It is the liquid crystal display according to claim 53 characterized by the distance from the side of the shape of tooth form of the saw of the above 2nd and the 3rd opening to the side of the aforementioned pixel electrode being fixed, and the range of the distance being 10 to 16 micrometers.
[Claim 56] The substrate for liquid crystal displays including the pixel electrode which has opening of the shape of tooth form of a saw, and the wiring currently formed so that it may superimpose on the aforementioned opening.
[Claim 57] The aforementioned wiring is a substrate for liquid crystal displays according to claim 56 which is gate wiring.
[Claim 58] The substrate for liquid crystal displays including the common electrode which has opening of the shape of tooth form of a saw, and the black matrix currently formed so that it may superimpose on the aforementioned opening.
[Claim 59] The 1st substrate in which the pixel electrode which has the 1st opening of the shape of tooth form of a saw is formed, The 2nd substrate in which the common electrode which has the 1st opening of the above and the 2nd opening of the shape of tooth form of the saw each other arranged by turns in parallel, and the black matrix are formed is included. A part for part I which superimposes the aforementioned black matrix on the 2nd opening of the above, The liquid crystal display which has a part for wrap part III for a part for part II currently formed in the form which crosses the portion by which the 1st opening currently formed in the shape of [of the aforementioned saw] tooth form and the 2nd opening were bent, and the portion to which the 1st opening of the above and the 2nd opening collide with the boundary of the aforementioned pixel electrode.
[Claim 60] The liquid crystal display according to claim 59 with which the wiring superimposed on the 1st opening of the above is further formed in the 1st substrate of the above.
[Claim 61] The aforementioned wiring is a liquid crystal display according to claim 60 which is gate wiring.
[Claim 62] The aforementioned black matrix is a liquid crystal display according to claim 59 which has further a part for part IV superimposed on the 1st opening of the above.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the liquid crystal display which has a latus angle of visibility, and it is related with the liquid crystal display of the method which extends an angle of visibility by forming a fixed pattern in a common electrode and a pixel electrode in more detail.
[0002]
[Description of the Prior Art] Generally, a liquid crystal display pours in liquid crystal between two substrates, and consists of structure of adjusting the amount of light transmissions, by adjusting the electric field strength added here.
[0003] Among these, the liquid crystal display of a perpendicular orientation (vertically aligned:VA) method can intercept light completely in the state where electric field are not impressed, when using the polarizing plate which intersects perpendicularly, since orientation of the liquid crystal molecule is perpendicularly carried out to the substrate in the state where electric field are not impressed. That is, the brightness of an OFF (off) state can obtain a high contrast ratio compared with the twist nematic liquid crystal display conventional by the low's very much in normally black mode (normally black mode). However, the portion the polarization direction of the polarizing plate of the upper part or the lower part and whose direction of a major axis of a liquid crystal molecule correspond since the direction to which a liquid crystal molecule inclines where electric field are impressed is irregular-like exists, and in this portion, in order not to demonstrate the function in which a liquid crystal molecule rotates the polarization direction of light, light is altogether intercepted with a polarizing plate. On a screen, such a portion appears black, reduces quality of image, and calls such a portion a texture (texture).
[0004] In order to solve such a problem, the method of carrying out patterning of the electrode is shown variously. However, by the conventional method of carrying out patterning of the electrode, troubles, like a speed of response is slow still exist.
[0005] Here, with reference to a drawing, the electrode pattern in the liquid crystal display by the Prior art and its trouble are explained.
[0006] Drawing 1 is the plan showing the state where the opening pattern formed in the vertical electrode of the liquid crystal display by the Prior art was overlapped.
[0007] The opening pattern 1 of the common electrode of a gestalt and the opening pattern 2 of a pixel electrode with which middle was bent are arranged at the gestalt which counters mutually, the liquid crystal matter is poured in between a common electrode and a pixel electrode, and orientation is perpendicularly carried out to the field of each electrode.
[0008] If electric field are impressed between a common electrode and a pixel electrode at this time, the liquid crystal molecule 3 will receive electric force, and will become width in parallel to an electrode side. When the reaction rate to the electric place of such a liquid crystal molecule 3 is called speed of response and the opening pattern is formed like drawing 1 a, a speed of response is very slow. The reason is as follows.
[0009] That is, it is because 2 stage operation mutually arranged in parallel by the true character of the nematic (nematic) liquid crystal which is going to become parallel mutually again once the fringe field (fringe field) is formed, a liquid crystal molecule receives the electric force of the fringe field and it is perpendicularly arranged to the opening patterns 1 and 2 with the opening patterns 1 and 2 (A state) (B stage) is performed.
[0010]
[Problem(s) to be Solved by the Invention] The speed of response with a late liquid crystal molecule becomes the factor which induces an after-image at the time of dynamic-image expression. Therefore, in order to raise the quality of a dynamic-image display, a speed of response with a quick liquid crystal molecule is required.
[0011] this invention is for solving the aforementioned technical problem, and it is in the purpose raising the speed of

response of a wide-field-of-view angle liquid crystal display.
[0012] Moreover, it is in the purpose of this invention raising the quality of image of a wide-field-of-view angle liquid crystal display.
[0013]
[Means for Solving the Problem] In order to attain the aforementioned purpose, in the liquid crystal display of this invention, opening of a vertical board is formed as much as possible in parallel, following a design rule.
[0014] Specifically, it is formed on the 1st substrate and formed in the inferior surface of tongue of the pixel electrode which has the 1st opening pattern, the; 1st substrate, and the 2nd substrate of an insulation which counters. In the liquid crystal matter poured in between the common electrode, and the; 1st substrate which have the 2nd opening pattern, and the 2nd substrate, and the liquid crystal display containing; the [the 1st opening pattern and] -- the center section is formed in the shape of a straight line, two opening patterns have it, and the 1st opening pattern and the 2nd opening pattern of each other are arranged for them by turns [mutually parallel]
[0015] The 1st opening by which the 1st opening pattern is formed in the up field of the aforementioned pixel electrode in the 1st direction at this time, The 2nd opening currently formed in the 2nd direction which makes the 1st direction of the above and a perpendicular to the lower field of a pixel electrode is included. the 2nd opening pattern The up field of a pixel electrode, the 1st trunk opening currently formed in the 1st direction in the corresponding position, and the lower field of a pixel electrode and the 2nd trunk opening currently formed in the corresponding position in the 2nd direction are included.
[0016] The 1st direction can be the direction of a slash to the side of a pixel electrode. the 2nd opening pattern The 1st branch opening superimposed on the vertical side of a pixel electrode and the 2nd branch opening superimposed on the right-and-left side of a pixel electrode are included. the 1st opening pattern the center of the upper and lower sides of the aforementioned pixel electrode -- being located -- the 3rd opening parallel to the vertical side of a pixel electrode -- containing -- the [the 1st opening pattern and] -- two opening patterns can be divided into the polygon to which a large number closed the pixel electrode Here, as for the 2nd branch opening, it is possible for width of face to be wider than trunk opening.
[0017] the 1st direction -- any one of the sides of a pixel electrode -- being able to be parallel -- the [the 1st and] -- they can be formed so that the ends of 2 trunk opening go to an edge, and width of face may become large gradually, and one of the 2nd trunk openings can be formed so that it may superimpose on the lower side of a pixel electrode Moreover, it can be formed so that the edge of the 1st opening goes to an edge, and width of face may become narrow gradually.
[0018] It adheres to the 1st polarizing plate and the 2nd polarizing plate under the 1st substrate and on the 2nd substrate, respectively, and the polarization direction of the 1st and 2nd polarizing plates can make 45 degrees with the 1st and 2nd directions, respectively, and can form a lobe in the side which adjoined the pixel electrode with the terminal point of the 1st and 2nd openings.
[0019] Moreover, it is formed on the 1st substrate and formed in the undersurface of the pixel electrode which has the 1st opening pattern, the; 1st substrate, and the 2nd substrate which counters. In the liquid crystal matter poured in between the common electrode, and the; 1st substrate which have the 2nd opening pattern, and the 2nd substrate, and the liquid crystal display containing; the [the 1st opening pattern and] -- two opening patterns are superimposed, a pixel electrode is divided into many small fields, and it is made for the two sides where a small field is the longest to become an parallel polygon mutually
[0020] At this time, a small field is divided into the 1st smallness field whose two longest sides are the 1st direction, and the 2nd smallness field whose two longest sides are the 2nd direction, and, as for the 1st direction and the 2nd direction, it is desirable to make 90 degrees. As for the 1st direction, it is possible for it to be parallel to one of the vertical side of a pixel electrode or the right-and-left sides in being the direction of a slash to the side of a pixel electrode.
[0021] The pixel electrode which has the 1st opening pattern is formed on the 1st substrate of an insulation. In the liquid crystal display with which the common electrode which has the 2nd opening pattern is formed in the 1st substrate and the 2nd substrate of an insulation which has countered, and the liquid crystal matter is poured in between the 1st substrate and the 2nd substrate the time of voltage being impressed between a pixel electrode and a common electrode -- the [the 1st and] -- it is made in agreement with the direction where orientation of the direction where orientation of the liquid crystal molecule of the liquid crystal matter is carried out by the fringe field formed with two opening patterns is carried out by the force between liquid crystal molecules
[0022] As for the direction of orientation of the liquid crystal molecule by the fringe field, at this time, being classified in the four directions is desirable.
[0023] the [of a more than / the 1st and] -- as for the width of face of two opening patterns, it is desirable that it is the

range of 10 to 16 micrometers
[0024] Specifically, it is formed on the 1st substrate and formed in the inferior surface of tongue of the pixel electrode which has the 1st opening pattern, the; 1st substrate, and the 2nd substrate of an insulation which has countered. The liquid crystal matter and; which are poured in between the common electrode, and the; 1st substrate which have the 2nd opening pattern, and the 2nd substrate are included. the 1st opening pattern It is formed in the 1st opening and the direction of; slash which are formed in the longitudinal direction from the 1st side of a pixel electrode. With the management who consists of the 2nd and 3rd openings to which the symmetry is mutually made to the 1st opening of the above, and an interval becomes large so mutually that the 1st aforementioned side is approached from the 1st aforementioned side and the 2nd side which counters, and; and by whom the 2nd opening pattern is formed in the longitudinal direction The 1st and the 2nd branch which become far mutually, so that it is formed in the direction of a slash from the aforementioned management, respectively and separates from the aforementioned management, It is formed in lengthwise from the above 1st and the 2nd branch. As opposed to the 5th opening and the 4th opening of; above containing 2 refraction sections the [the 1st currently formed in a longitudinal direction and lengthwise, respectively from the ends of the 1st center section parallel to the 4th opening and the 1st branch of; above including the 1st and the 2nd branch edge which have been mutually extended to opposite direction, and the 1st center section of the above, and] -- from the 5th opening of the above, the 6th opening which makes the symmetry, and; -- becoming -- the [the 1st opening pattern and] -- two opening patterns will propose the liquid crystal display formed so that it may be located by turns, if a liquid crystal display is seen from a top
[0025] the [the 1st formed in a pixel electrode and a common electrode at this time, and] -- two opening patterns may be formed in the following various gestalten besides this
[0026] The 1st slash section by which the 1st opening pattern is formed in the direction of a slash toward the 2nd side which counters this from the 1st side of a pixel electrode, The 1st opening containing the 2nd slash section which is bent from the 1st slash section and formed in the direction of a slash toward the 1st side is included. the 2nd opening pattern The 2nd opening containing the ramus-transversus section extended in the longitudinal direction from the center of the fundus currently formed in lengthwise, and a fundus, 2 slash branch is included. the [the 1st extended in the direction of a slash, respectively from the ends of the center section currently formed in lengthwise, and the aforementioned center section, and] -- from the 3rd opening which makes the symmetry to the 2nd opening of the above -- becoming -- the [the 1st opening pattern and] -- if a liquid crystal display is seen from a top, two opening patterns can be arranged so that it may be located by turns
[0027] Moreover, the 1st opening by which the 1st opening pattern is investigated toward the 2nd side which counters this from the 1st side of a pixel electrode, The 2nd opening investigated [aforementioned] toward the 1st aforementioned side from the 2nd side is included. the 2nd opening pattern The 1st slash section currently formed in the direction of a slash, and the 2nd slash section which was bent from the aforementioned 1st slash section and has been extended in the direction of a slash, The 3rd opening can also arrange each field of the pixel electrode classified into three fields by the 1st and 2nd openings in the gestalt divided into two, respectively including the 3rd opening including the 3rd slash view which was bent from the aforementioned 2nd slash section and has been extended in the same direction as the aforementioned 1st slash section.
[0028] An opening pattern has various gestalten like the example explained below besides this.
[0029] At this time, the polarization direction of the 1st and 2nd polarizing plates can be arranged in a longitudinal direction and lengthwise or lengthwise, and a longitudinal direction, respectively, including further the 1st polarizing plate currently formed in the bottom of the 1st substrate, and the 2nd polarizing plate currently formed on the 2nd substrate, and, as for the width of face of the 1st or 6th opening, it is desirable that it is the range of 10 to 16 micrometers.
[0030]
[Embodiments of the Invention] Hereafter, the structure of the liquid crystal display by the example of this invention is explained based on a drawing.
[0031] Drawing 2 is the cross section showing the rough structure of the liquid crystal display by the example of this invention.
[0032] A liquid crystal display consists of liquid crystal matter 30 by which is poured in between the lower substrate 10, this and the up substrate 20 which has countered, and the lower substrate 10 and the up substrate 20, and orientation is perpendicularly carried out to substrates 10 and 20.
[0033] The pixel electrode 12 which consists of transparent conductive material, such as ITO (indium tinoxide) or IZO (indium zinc oxide), on the lower substrate 10 which consists of transparent insulating material, such as glass, and has the opening pattern (not shown) is formed, and each pixel electrode 12 is connected with a switching element 11, and receives impression of picture signal voltage. At this time, usually as a switching element 11, TFT is used, and TFT is

connected with the data line (not shown) which transmits the gate line (not shown) and picture signal which transmit a scanning signal, respectively, and makes the pixel electrode 12 ON (on) or OFF (off) according to a scanning signal. Moreover, the inferior surface of tongue of the lower substrate 10 adheres to the lower polarizing plate 14. Here, the pixel electrode 12 does not need to consist of transparent matter, when it is a reflected type liquid crystal display, and in this case, the lower polarizing plate 14 also becomes unnecessary.

[0034] The common electrode 23 which serves as the black matrix 21 for preventing optical leakage from transparent conductive material, such as the light filter 22 of red, green, and blue and ITO, or IZO, and has opening (not shown) is formed in the inferior surface of tongue of the up substrate 20 which consists of transparent insulating material, such as glass, like the aforementioned lower substrate. At this time, the black matrix 21 and a light filter 22 can also be formed on the lower substrate 10. Moreover, the upper surface of the up substrate 20 adheres to the up polarizing plate 24.

[0035] The polarization direction of the lower polarizing plate 14 and the up polarizing plate 24 is arranged so that it may intersect perpendicularly mutually in normally black mode (normally black mode), and it is mutually arranged in parallel by the normally white mode (normally white mode). Below, only normally black mode is taken into consideration.

[0036] Inside the outside polarizing plates 14 and 24 of two substrates 10 and 20, it adheres to the compensation films 15 and 25, respectively. At this time, a plate optically uniaxial compensation film is adhered to the unilateral of the two substrates, c plate optically uniaxial compensation film can be adhered to an opposite side, or c plate optically uniaxial compensation film can be adhered to both sides. Although an optically-biaxial compensation film can also be used instead of an optically uniaxial compensation film, an optically-biaxial compensation film can also be adhered only to the unilateral of the two substrates in this case. It adheres so that it may intersect [whether in a plate or an optically-biaxial compensation film, the direction of adhesion direction of a compensation film of the maximum / refractive index /, i.e., a late shaft, (slow axis) corresponds with the transparency shaft of a polarizing plate, and] perpendicularly.

[0037] Subsequently, with reference to a drawing, the opening pattern of the pixel electrode of the liquid crystal display by the example of this invention and a common electrode is explained.

[0038] Drawing 3 a and 3b are the plans showing the state where the opening pattern formed in the vertical electrode of the liquid crystal display by the 1st and 2nd examples of this invention was overlapped, respectively.

[0039] In order to raise a speed of response, the opening patterns 1 and 2 are formed in an parallel straight line, and it is made for the state where the liquid crystal molecule 3 was arranged by the fringe field to be in an parallel state between liquid crystal molecules like drawing 3 a. If it carries out like this, since the movement of a liquid crystal molecule is completed in 1 stage operation, a speed of response will become quick.

[0040] However, when the opening patterns 1 and 2 are formed like drawing 3 a, a texture (texture) is missing from the latus range, and it generates remarkably. Moreover, a white after-image (phenomenon which becomes momentarily brighter than the color of the surrounding ground when returning to the ground of an again bright color, after displaying a dark color on the ground of a bright color) may occur.

[0041] In order to improve such a trouble, the loose opening patterns 1 and 2 of a curvilinear form can be taken into consideration as shown in drawing 3 b. However, with such a gestalt, since 1 stage operation with a perfect liquid crystal molecule cannot be performed, the trouble that a working speed becomes slow again occurs.

[0042] The opening pattern hereafter designed in consideration of both poor suppression, such as improvement in a working speed and a texture, is explained.

[0043] Drawing 4 a, and 5a, 6a, 7a, 8a, 9a and 10a are the plans showing the pattern of the pixel electrode of the liquid crystal display by the 3rd or 9th example of this invention, respectively. Drawing 4 b, and 5b, 6b, 7b, 8b, 9b and 10b are the plans showing the opening pattern currently formed in the common electrode of the liquid crystal display by the 3rd or 9th example of this invention, respectively. Drawing 4 c, and 5c, 6c, 7c, 8c, 9c and 10c are the plans in the state where the pattern of a pixel electrode and the opening pattern of a common electrode were made to superimpose where the vertical substrate of the liquid crystal display by the 3rd or 9th example of this invention is aligned, respectively.

[0044] First, the 3rd example of this invention is explained. The 1st opening 121 thinly dug in left-hand side is formed in the pars intermedia of the rectangular pixel electrode 12 from the right-hand side, and the angle was cut off and it has turned at the both sides of the entrance of the 1st opening 121 at the loose angle as shown in drawing 4 a (henceforth "chamfering"). If the pixel electrode 12 is classified into the upper part and the lower part focusing on the 1st opening 121, the 2nd and 3rd openings 122 and 123 are formed in the upper part and the lower part, respectively. The 2nd and 3rd openings investigate the upper part and the lower part of the pixel electrode 12 to the diagonal line, respectively, are formed, and are making the symmetry mutually. The 2nd and 3rd openings 122 and 123 are gestalten which opposite direction delves into and become far from the 1st opening 121 in the 1st opening 121.

[0045] The 4th opening including the 1st and the 2nd branch edges 213 and 215 which have been extended up and

down to lengthwise is formed [branches / the 1st and 2nd / 212 and 214 / the 1st / the / and 2nd branches 212 and 214 extended up and down in the direction of a slash, and] from the management 211 currently formed in the longitudinal direction, and management 211 at the common electrode 23, respectively as shown in drawing 4 b. Moreover, the 5th opening and the 6th opening which is making the symmetry are formed in the common electrode 23 to the 5th opening including the 1st branch 212, the center section 221 currently formed in the direction of a slash in parallel, the horizontal edge 222 extended in the longitudinal direction from the center section 221, and the vertical edge 223 extended from the center section 221 to lengthwise, and the 4th opening. The 4th, the 5th, and 6th openings of such arrangement are repeatedly formed in the common electrode 23.

[0046] The 4th or 6th opening of the 1st or 3rd opening 121, 122, and 123 of the pixel electrode 12 and the common electrode 23 is overlapped, and the pixel electrode 12 is divided into many fields as shown in drawing 4 c. At this time, the openings 121, 122, and 123 of the pixel electrode 12 and opening of the common electrode 23 are arranged by turns. The 1st or 6th opening of each other is formed in parallel in most fields except the 1st opening 121 which divides the center of the pixel electrode 12, the management 211 of the 4th opening, the branch edges 213 and 215 of the 4th opening superimposed on the side of the pixel electrode 12, the horizontal edges 222 and 232 of the 2nd and 3rd openings and the vertical edge 223, and 233.

[0047] At this time, the vertical polarizing plates 14 and 24 are arranged so that the polarization direction may turn into a longitudinal direction (0 degree), lengthwise (90 degrees) or lengthwise, and a longitudinal direction, respectively.

[0048] Since the number which becomes width in the polarization direction of polarizing plates 14 and 24 among the liquid crystal molecules in which the rearrangement was carried out by impression of an electric place will decrease as shown in drawing 4 c if it carries out like this, generating of a texture decreases. Moreover, since a liquid crystal molecule is surely in an parallel state mutually for the state where the liquid crystal molecule was arranged by the fringe field, the movement of a liquid crystal molecule is completed in 1 stage operation. Therefore, a speed of response is very quick. Furthermore, opening is greatly extended to the 2-way in the pixel field, and this 2-way is making 90 degrees mutually. Moreover, since opening of a vertical substrate is arranged by turns mutually, the direction of the fringe field is classified in the four directions in one pixel field. Therefore, a latus angle of visibility can be obtained in the four directions of all.

[0049] The 4th example of this invention is explained. The 1st opening containing the 1st slash section 121 extended from the right-hand side of the pixel electrode 12 in the direction of a slash to the upper left side and the 2nd slash section 122 which is connected at the 1st slash section 121 and has been extended in the direction of an upper right side slash is formed, and, as for a part for the left-hand side corner of the pixel electrode 12, chamfering is performed as shown in drawing 5 a. At this time, the position where the 1st slash section 121 and the 2nd slash section 122 collide with is a center section which halves the pixel electrode 12 in the upper part and the lower part.

[0050] The 2nd opening which contains in the common electrode 23 the fundus 211 extended to lengthwise and the ramus-transversus section 212 extended in the left-hand side longitudinal direction from the center of a fundus 211 is formed as shown in drawing 5 b. At this time, width of face becomes narrow, so that the 2nd opening separates from the point where a fundus 211 and the ramus-transversus section 212 collide with, and as for the both-sides angle of a point which a fundus 211 and the ramus-transversus section 212 collide with, chamfering is performed. the [moreover, / the 1st extended to the upper right and lower right side, respectively from the ends of the center section 221 currently formed in the common electrode 23 lengthwise, and a center section 221, and] -- the 3rd opening containing 2 slash branches 222 and 223 is formed At this time, the 3rd opening is arranged to the 2nd opening at the vertical symmetry.

[0051] The 2nd and 3rd openings of the 1st opening of the pixel electrode 12 and the common electrode 23 are overlapped, and the pixel electrode 12 is divided into many fields as shown in drawing 5 c. At this time, the 1st opening is located between the 2nd opening and the 3rd opening. Moreover, the 1st or 3rd opening of each other is arranged in parallel except ramus-transversus section [which halves the pixel electrode 12 up and down] 212, fundus [which is superimposed on the side of the pixel electrode 12] 211, and center-section 221. It also performs having performed chamfering in the core of the left-hand side angle of the pixel electrode 12, and the 2nd opening as one of the methods for arranging opening in parallel.

[0052] At this time, the vertical polarizing plates 14 and 24 are arranged so that the polarization direction may become being the same as that of the 3rd example.

[0053] Thereby, the same effect as the 3rd example can be acquired.

[0054] The 5th example of this invention is explained. The 1st opening 121 investigated by top 1 / 3 point of the pixel electrode 12 on left-hand side from the right-hand side and the 2nd opening 122 investigated by bottom 1 / 3 point on right-hand side from left part are formed in the pixel electrode 12 as shown in drawing 6 a. Chamfering is performed and, as for the both-sides angle of the entrance of openings 121 and 122, chamfering is performed also for the upper

left of the pixel electrode 12, and the lower right angle.
[0055] The 3rd opening which contains in the common electrode 23 the 1st slash section 211 extended to the lower left side, the 2nd slash section 212 which was bent from the 1st slash section 211 and has been extended to the lower right side, and the 3rd slash section 213 which was bent from the 2nd slash section 212 and has been extended to the lower left side is formed as shown in drawing 6 b.
[0056] The 3rd opening is dividing into two each field of the pixel electrode 12 divided into three fields by the 1st and 2nd openings, respectively as shown in drawing 6 c.
[0057] At this time, the vertical polarizing plates 14 and 24 are arranged so that the polarization direction may become being the same as that of the 3rd example.
[0058] The 6th example of this invention is explained. The 1st rectangular opening 121 and the 2nd opening 122 were formed in top 1 / 3 point of the pixel electrode 12, and bottom 1 / 3 point, respectively, and the pixel electrode 12 is equally divided into three as shown in drawing 7 a.
[0059] The 3rd or 5th opening 210, 220, and 230 of X typeface sets a fixed interval, and is arranged in the vertical direction at the single tier as shown in drawing 7 b. As for the angle currently formed in the intersection of each center of openings 210, 220, and 230, chamfering is performed.
[0060] The 3rd or 5th opening 210, 220, and 230 is quadrisecting each field of the pixel electrode 12 equally divided to three fields by the 1st and 2nd openings 121 and 122, respectively as shown in drawing 7 c.
[0061] At this time, they are the vertical polarizing plates 14 and 24. If a longitudinal direction is made into criteria (0 degree) It arranges so that the polarization direction may become 45 degrees and 135 degrees, respectively.
[0062] The 7th example of this invention is explained. The 1st opening containing the vertical section 111 which divides the upper surface of the pixel electrode 12 into two at right and left, and the horizontal level 112 which is connected with the soffit of a vertical section 111 and divides the pixel electrode 12 up and down, and the 2nd opening 120 of the rectangle which divides into two the lower field of the pixel electrode 12 divided by the horizontal level 112 are formed in the pixel electrode 12 as shown in drawing 8 a.
[0063] It is formed in lengthwise, and is mutually formed in the 3rd and 4th parallel openings 210 and 220 and the lower part of the 3rd and 4th openings 210 and 220 at the longitudinal direction, and the 5th and 6th parallel openings 230 and 240 of each other are formed in the common electrode 23 as shown in drawing 8 b. At this time, width of face is extended gradually and the ends of the 5th and 6th openings 230 and 240 are formed in the triangle.
[0064] The 1st opening of the pixel electrode 12 and the 3rd and 4th openings 210 and 220 of the common electrode 23 have divided the upper surface of the pixel electrode 12 into four equally perpendicularly, and the 2nd opening 120, the 5th, and 6th openings 230 and 240 have divided the inferior surface of tongue of the pixel electrode 12 into four equally horizontally as shown in drawing 8 c.
[0065] At this time, the vertical polarizing plates 14 and 24 are arranged so that the polarization direction may become being the same as that of the 6th example.
[0066] If it carries out like this, since the direction where opening becomes parallel mutually in most fields, and a liquid crystal molecule becomes width will also come to make the polarization direction and 45 degrees, a quick speed of response and good quality of image with few textures can be obtained. Opening is greatly extended in the two directions in the pixel field, and these two directions are making 90 degrees mutually. Moreover, since opening of a vertical substrate is arranged by turns mutually, the direction of the fringe field is classified in the four directions in one pixel field.
[0067] The octavus example of this invention is explained. The 1st opening 110 extended for a long time in the longitudinal direction is formed in the about 1/3 lower part [of the pixel electrode 12] portion as shown in drawing 9 a.
[0068] The 1st and the 2nd branch 212 and 213 which are connected with lengthwise at the soffit of the management 211 extended for a long time and management 211, and have been extended on right-hand side and left-hand side, respectively as shown in drawing 9 b, The 2nd opening containing the upper-limit section 214 which is connected with management's 211 upper limit and formed in the inverse triangle, and the 3rd opening 220 currently formed in the lower part of the 2nd opening for a long time at the longitudinal direction are formed in the common electrode 23. At this time, the 1st and 2nd branches 212 and 213 lean to the bottom slightly, without being formed horizontally, width of face is extended gradually and the ends of the 3rd opening 220 are formed in the triangle.
[0069] The pixel electrode 12 is divided into the upper surface and an inferior surface of tongue by the 2nd opening, the upper surface of these is halved by management 211 at right and left, and the inferior surface of tongue of the pixel electrode 12 is trichotomized by the 1st opening 110 and the 3rd opening 220 as shown in drawing 9 c.
[0070] At this time, the vertical polarizing plates 14 and 24 are arranged so that the polarization direction may become being the same as that of the 6th example. The 7th example and a similar effect can be acquired by this.

[0071] Finally the 9th example of this invention is explained. The pixel electrode 12 is formed in the gestalt by which four ellipses are connected with the single tier as shown in drawing 10 a.
[0072] To the common electrode 23, an interval with the 1st fixed opening 210 of four rhombuses is set, it is arranged by the single tier, and the 2nd and 3rd openings 220 and 230 are formed in the gestalt surrounding the 1st opening 210 as shown in drawing 10 b. The valley is formed in the shape of [of the curve-ized saw] tooth form, the side which faces the 1st opening 210 among the sides of the 2nd and 3rd openings 220 and 230 is making the bilateral symmetry to the 1st opening 210, and the mountain portion of the gear tooth of a saw is formed so that it may be located between the 1st opening 210.
[0073] The 1st opening 210 is located in the center of each ellipse which makes the pixel electrode 12, and the 2nd and 3rd openings 220 and 230 have surrounded the pixel electrode 12 as shown in drawing 10 c. At this time, the distance from the side of the shape of tooth form of the saw of the 2nd and 3rd openings 220 and 230 to the side of the pixel electrode 12 is arranged so that it may become fixed.
[0074] At this time, the vertical polarizing plates 14 and 24 are arranged so that the polarization direction may become 0 degree and 90 degrees, respectively.
[0075] the conditions of the opening pattern for the following division orientation acquired from the result of the experiment with the above various example [the 3rd or 9th] -- the maximum ****** -- an opening pattern is formed so that things may be made
[0076] It is good that the field by which quadrisection orientation was carried out to the 1st in order to obtain the best angle of visibility is contained in one pixel.
[0077] In order to acquire the division orientation stabilized in the 2nd, neither disclination (disclination) nor an irregular organization (texture) must not occur in a place except the boundary of the divided minute field. It generates, when the direction child of a liquid crystal molecule is arranged in the various directions in the narrow field, without being arranged in the fixed direction, and disclination is generated when falling in the direction which a liquid crystal molecule collides with mutually in one field especially. Therefore, in order to acquire the stable division orientation, it is advantageous that the pattern of a vertical substrate is formed repeatedly, and as the end of the pattern of a finish plate and the pattern of a underplate is near, it is better. That is, when a liquid crystal display is seen from a top, it is good to become the gestalt approximated to the polygon which the field formed with the pattern of a finish plate and the pattern of a underplate closed. Moreover, since it is easy to generate disclination when the pattern formed in one substrate makes an acute angle, in order to form one field, as for a pattern, forming only with an obtuse angle is good. Moreover, the stable division orientation becomes the cause which also affects brightness. In the field in which orientation was confused, while light comes to leak by the OFF state, when it will be in a dark state compared with other surrounding portions by the ON state and the array of a liquid crystal molecule changes, the portion into which the array was confused moves and it is in causes, such as an after-image, also with a bird clapper.
[0078] You have to fulfill the following conditions, in order to obtain high brightness to the 3rd. First, as for the angle which the direction child (director) of liquid crystal of the adjoining field makes, it is most desirable to become 90 degrees. When becoming like this, it is for disclination to occur only in the narrowest field, and the highest brightness can be obtained when the angle which the transparency shaft and the direction child of liquid crystal of a polarizing plate make makes 45 degrees. moreover, the angle into which the opening pattern currently formed in the finish plate and the underplate, respectively bends or breaks -- as much as possible -- being so slow (that it being close to a straight line) -- it is desirable
[0079] the angle into which the opening pattern currently formed in the finish plate and the underplate, respectively bends or breaks in order to obtain a quick speed of response at the end -- as much as possible -- being so slow (that it being close to a straight line) -- it is desirable That is, it is advantageous to resemble most the gestalt which counters with the character of 1 in respect of a speed of response.
[0080] Subsequently, the influence the width of face of an opening pattern and the interval between patterns affect permeability and a speed of response is explained. In order to investigate the influence by the width of face and the interval of an opening pattern, it made and experimented in the panel which has nine opening patterns shown in drawing 11 .
[0081] The pattern displayed with the slash in drawing 11 is an opening pattern of a common electrode, and the pattern shown by the thick line is the gestalt of a pixel electrode.
[0082] B, C, D pattern, and E, F and G pattern are patterns of the same gestalt with which only the width of face and the interval of a pattern differ from each other, respectively, and I differs in the interval between patterns from J pattern. Although A pattern is similar with B, C, and D pattern, the intervals between patterns differ. The width of face and the interval of each [these] pattern are shown in Table 1.
[Table 1]

	パターン幅 (μm)	パターン間隔 (μm)
A	10	33.5
B	10	22.5
C	7	25.5
D	13	19.6
E		24
F		21
G		27
I	10	ショート :29 ロング :32
J	10	ショート :10 ロング :16

[0083] Drawing 12 a is the graph which showed the light transmittance of the test cell (test cell) to each pattern at percent (%), and drawing 12 b is the graph which showed the ratio of the light transmittance of other patterns on the basis of the light transmittance of B pattern.
[0084] The light transmittance of G pattern is the highest at about 13%, and the degree is the order of E, I, B, D, A, C, F, and J pattern as shown in the graph of drawing 12 a and 12b.
[0085] Drawing 13 is a graph which shows the response time by the gradation of the test cell which applied each pattern. Although even 64 gradation was used when actually applying, in this experiment, it experimented up to 110 gradation.
[0086] The response time of B, C, D, and J pattern is comparatively short at all gradation as shown in drawing 13 . That is, the speed of response was quick. In the case of A and I pattern, the reason nil why a speed of response is slow is for texture movement by other patterns, and, in the case of E, F, and G pattern, it is for a liquid crystal molecule to carry out 2 stage operation.
[0087] Table 2 is the result of experimenting on an actual panel with the application of nine patterns of drawing 11 . It made and experimented in four panels to each pattern.
[Table 2]

パターン	T(%)	Ton(ms)	Toff (ms)	Ttotal (ms)	白残像	T(%)	Ton(ms)	Toff (ms)	Ttotal (ms)	白残像
A	5.50	21.53	20.38	41.73	中	5.12	18.56	13.99	32.55	弱
	5.44	19.14	20.18	39.32	強	4.27	14.69	15.15	29.84	弱
B	5.23	18.16	20.28	38.44	微弱	4.79	12.36	14.5	26.86	X
	4.88	18.79	20.42	39.21	微弱	4.56	12.64	15.48	28.12	X
C	4.96	18.8	21.6	40.4	強	4.07	9.6	14.8	24.4	強
						4.19	8.98	14.3	23.28	強
D	4.88	24.36	21.2	40.0	X	4.75	12.8	14.8	27.6	X
						4.79	13.36	13.47	26.83	X
E	5.52	22.2	21.69	46.05	微弱	5.34	44.11	14.28	58.39	X
	5.58	23.67	20.0	42.2	微弱					
F	4.79	20.8	21.63	45.2	X	4.34	70.79	14.89	85.68	X
	5.58	20.8	19.2	40.0	X					
I	5.51	15.0	21.6	42.4	弱	4.99	10.4	13.0	23.4	微弱
						4.77	12.6	15.4	28	X
J	4.76		20.8	35.8	弱	4.49	7.6	12.4	20.0	弱
						3.96	9.6	15.4	25.0	弱

[0088] The result of an actual panel was also similar with the result of a test cell. However, unlike the test cell, the speed of response of I was comparatively quick, and the brightness of J pattern was brighter than anticipation (although the brightness of J pattern was about 75% compared with B pattern in the test cell, compared with B pattern, it was

90% by the actual panel).
[0089] As for A, C, I, and J pattern, the white after-image appeared by the actual panel. Although it becomes a problem by C pattern since a white after-image appears strongly, the grade which are I and J pattern can improve.
[0090] Based on the above result, the pattern which can be chosen according to the property which it is going to improve is explained.
[0091] First, when it is going to improve a speed of response, maintaining brightness beyond the present level, B, D, and I pattern are desirable, and when aiming at improvement in a speed of response at the sacrifice of brightness, D and J pattern are advantageous [when aiming at the improvement in brightness, and a white after-image improvement, B, D E, and I pattern are advantageous, and].
[0092] Subsequently, in order to clarify more relation between a speed of response and the width of face of an opening pattern, a gestalt is the same and the difference of an optical property is explained to B and C from which the width of face of a pattern differs, and D pattern.
[0093] Drawing 14 is a graph which shows the response time by the gradation of B in an actual panel, C, and each D pattern.
[0094] The response time between 20 gradation and 40 gradation was long in order of D<B<C. Namely, the response time is so short that the width of face of a pattern is large.
[0095] From about 40 gradation, the response time of C pattern is shorter than B pattern, and the response time of C pattern is shorter than D pattern from about 45 gradation. However, it only seems to this for a white after-image phenomenon that the response time is short, and it is not actually short. That is, for a white after-image, a response waveform distorts and the response time looks actually more short. Therefore, when an example is taken in such a point, a speed of response is quick and a bird clapper understands the width of face of a pattern for latus.
[0096] if the high voltage of 60 or more gradation is built -- a texture -- although a speed of response becomes slow rapidly since it is uneasy -- among those -- coming out -- it has the property (it increases gently) in which the width of face of a latus D pattern of an opening pattern was most stable most
[0097] Drawing 15 is a microphotography in the white gradation to C, B, and D pattern. Low C of brightness of texture stability is the darkest, and, as for B and D, it has the approximated luminosity as shown in the photograph. Since the width of face of D of an opening pattern is large, although a numerical aperture is low, it has brightness with comparatively high texture stability. It is thought that texture stability is also determined by the strength of the fringe field and the width of face of a pattern.
[0098] Moreover, the gestalten of the boundary section (portion in which the opening pattern is formed) of a field differ. Although a texture forked in almost all the portions of the field boundary section appears vividly in the case of C pattern, and a forked texture appears faintly when it is B pattern, in the case of D pattern, the field boundary section appears as one linea nigra.
[0099] Drawing 16 is a domain division photograph according to applied voltage of the test cell to C pattern and D pattern. In the case of C pattern, it becomes so clear that a forked texture appears in the field boundary section from 3.5V and voltage becomes high. However, after being set to 5V in the case of D pattern, the field boundary section is faintly divided into two forks. The field boundary section is divided into two forks because a liquid crystal molecule is unevenly arranged in the field. In order to explain this phenomenon, the strength of the fringe field according to the width of face of a pattern is considered.
[0100] Drawing 17 is the conceptual diagram showing the strength of the fringe field according to the width of face of a pattern. The horizontal component of the fringe field becomes large, so that the width of face of an opening pattern becomes large. A horizontal component plays a role important for determining the direction where liquid crystal becomes width. Therefore, it is effective for the opening pattern of latus width of face forming a domain. Moreover, the strength of the vertical component of the electric place of the center of opening becomes so weak that the width of face of an opening pattern becomes large.
[0101] Drawing 18 is a drawing in which the array state of the liquid crystal molecule in the circumference of an opening pattern is shown. When the width of face of an opening pattern is narrow, a liquid crystal molecule becomes width to some extent also in the core of opening. Although the voltage impressed is the grade which inclines to a low case slightly, if voltage becomes high, it will become width completely horizontally. This is because the vertical component of an electric place is strong also in the center section of the opening pattern. For this reason, light comes to leak and the field boundary section comes to be divided into a forked line. Moreover, when changing 180 degrees of directions where a liquid crystal molecule becomes width by opening, since the width of face of opening is narrow, an elastic force is strong. On the other hand, since the horizontal component of the fringe field is weak, it cannot win an elastic force in the fringe field. Therefore, the array of the liquid crystal molecule in the field boundary section is uneven. The array of such an uneven liquid crystal molecule spreads to the interior of the small field of a pixel.

[0102] As for a liquid crystal molecule, the width of face of an opening pattern stands on a latus case perpendicularly at the center of opening. Although a liquid crystal molecule inclines slightly in connection with applied voltage becoming strong, compared with the case where width of face is narrow the extent, it is not remarkable. Therefore, there is little leaking light and the small field boundary section appears as one linea nigra.
[0103] As mentioned above, the width of face of a speed of response of an opening pattern is as quick as latus, and the small field which is a pixel is uniform. Although latus and a numerical aperture have the small width of face of an opening pattern, since the array of a liquid crystal molecule becomes uniform, brightness is good. According to the above experiment, about 13**3 micrometers is suitable for the width of face of an opening pattern. At this time, a cell gap (cell gap) is about 4 micrometers or about 6 micrometers.
[0104] Hereafter, the optical property according to the interval between opening patterns is explained. The width of face of a pattern of I pattern and J pattern is the same, and the intervals between patterns differ mutually. Although I pattern and J pattern have a remarkable difference in an optical property in the result of a test cell, there is no big difference at the result of an actual panel. This is presumed to be what is depended on the difference in the kind of orientation film, the difference in the existence of a protective coat (insulator layer), the difference in the voltage waveform impressed, etc. However, when an actual panel compares the traverse speed of a moving picture, the J pattern is quicker than I pattern (it is black on a gray background, and if a square is lengthened, it understands). However, a difference is in a speed of response with gradation.
[0105] In the width of face of an opening pattern, although a numerical aperture will decrease notably if the distance between patterns becomes narrow, brightness does not have a big difference. This is for a texture. That is, control will become easy if texture control will become difficult if the distance between patterns becomes large, and it becomes narrow. Therefore, since a numerical aperture can control a texture appropriately although it decreases if the distance between patterns becomes narrow, brightness is compensated. However, although I pattern is the one where the distance between patterns is distant, since texture control is performed comparatively appropriately, brightness is high.
[0106] As a conclusion, a gradation speed of response improves, so that the interval between patterns is narrowed. Although the probability of brightness that only the part to which a numerical aperture decreases will become low is high, it picks up to some extent by controlling a texture.
[0107] A texture has a speed of response and deep relation. The texture which moves reduces a speed of response. Impression of high voltage reduces a speed of response by most patterns. This is for a texture to occur. Therefore, if a texture is controlled appropriately, a speed of response may also be raised as well as the improvement in quality of image. How to suppress generating of a texture below is explained.
[0108] Drawing 19 and 20 are the portion which a texture generates by B pattern and J pattern, and the drawing to which this was expanded, respectively.
[0109] The opening pattern of drawing 19 is mostly similar with the pattern of drawing 4 c. However, the 2nd and 3rd openings 122 and 123 currently formed in the pixel electrode 12 differ from drawing 4 c. That is, it has begun from the right-hand side side. Moreover, a pixel electrode is made to project outside into the portion which the 2nd and 3rd openings 122 and 123 finish, and is formed in it. This is for preventing that connection of each portion of the pixel electrode 12 becomes poor by openings 122 and 123.
[0110] The portion which a texture generates is a portion which the edge of opening of a common electrode and the edge of opening of a pixel electrode mainly collide with. Although there is little generating of a texture when alignment of a vertical substrate is performed correctly, when it incorrect-aligns, a crescent texture occurs. The texture generated at this time does not generate a white after-image phenomenon. As texture restrictive measures, width of face of the edge of opening of a common electrode may be made large. The alignment limits of error are extended through this.
[0111] Although the pattern of drawing 20 is similar with the pattern of drawing 8 c, the number of lateral openings differs. Moreover, the point that opening of the longitudinal direction of a pixel electrode has begun from one side differs also from the point that the lobe is formed in the edge of lateral opening.
[0112] The part which a texture generates is the edge (a) of opening of the longitudinal direction of a common electrode. Moreover, a texture occurs by forming a contact mouth for connection to a source electrode also at the edge (c) of the soffit section (b) of the pixel electrode in which the gestalt was dented, and lengthwise opening of a pixel electrode. The texture restrictive measures are as follows. In the case of a portion, width of face of the edge of opening of a common electrode is made large. It is made for opening of a common electrode to be overlapped on b portion in the case of b portion. For that, the width of face of opening and an interval need to be adjusted. Although a numerical aperture decreases in narrowing an interval, a speed of response improves. In the case of c portion, the edge of lengthwise opening of a pixel electrode is formed in the sharp gestalt.
[0113] The pattern which applied the above texture improvement casting plans is shown in drawing 21 or 21c.

[0114] On the other hand, the field which a texture generates can be covered by gate wiring or the black matrix.
[0115] Drawing 22 and 23 are the plans of the TFT substrate of the liquid crystal display by the 10th example of this invention, and a light-filter substrate, respectively.
[0116] It is formed in the same gestalt as the opening 27 for the gate line 21 which transmits a scanning signal forming the division orientation currently formed in the pixel electrode 20, i.e., a trapezoid gestalt without the lower side, as shown in drawing 22 . The fall of the optical leakage by the opening 27 by which the gate line 21 which consists of a metal intercepts the light which enters from the rear-face light source, and is formed in the pixel electrode 20 of a TFT substrate of this, or brightness can be prevented.
[0117] Subsequently, it is formed in the light-filter substrate so that the black matrix 11 may cover the field which a texture generates, and the portion in which opening by the side of a light-filter substrate was formed as shown in drawing 23 . The field which a texture generates is the portion by which the openings 17 and 27 of the field between the boundaries of the opening 27 of a TFT substrate and the pixel electrode 20 and the tooth form of a saw were bent as mentioned above. Such a texture the black matrix pattern of a wrap sake The periphery section 111 which was formed in the gestalt which surrounds the field where the pixel electrode is formed in the bottom substrate as shown in drawing 23 , and defines the pixel field, The portion 112 formed in the wrap sake in the portion in which the opening 17 for forming division orientation was formed at the gear-tooth gestalt of a saw, The texture which generates the texture generated among the openings 17 and 27 of the gear-tooth gestalt of a saw in the portion 113 formed in the wrap sake with the triangle and the portion by which the openings 17 and 27 of the gear-tooth gestalt of a saw are bent consists of portions 114 which cross the middle of a pixel field to a wrap sake. By this, the optical leakage generated by the portion which a texture generates, or opening can be intercepted using a black matrix. Moreover, since it cannot say that the portion in which opening is formed, and the portion which a texture generates are portions which contribute to a display originally even if it forms a black matrix in latus area comparatively in this way, the problem on which a numerical aperture decreases is not generated.
[0118] Drawing 24 is the plan of the liquid crystal display which combined and formed two substrates as shown in drawing 22 and 23, and drawing 25 is the cross section of the XXV-XXV' line of drawing 24 .
[0119] The gate line 21 is formed in the trapezoid gestalt no lower side is [gestalt] in the TFT substrate 200 which is a lower substrate, and the insulator layer 22 is covered on it as shown in drawing 24 and 25. The pixel electrode 23 is formed on the insulator layer 22, a part of pixel electrode 20 of the gate line 21 top is removed, and it forms the opening 27 of the gear-tooth gestalt of a saw. On the pixel electrode 20, the perpendicular orientation film 24 for carrying out orientation of the liquid crystal molecule perpendicularly is formed.
[0120] On the other hand, patterning is carried out to the light-filter substrate 100 which is a top substrate so that both the outside whose black matrix 11 is a pixel, the portion in which opening for division orientation is formed, and the portion which a texture generates can be covered. The ITO common electrode 13 which the light filter 12 is formed in the pixel field between the black matrices 11, and the protection insulator layer 15 is formed on the black matrix 11 and the light filter 12, and is formed on it is at the gestalt from which the portion superimposed on the black matrix 11 was removed, and patterning is carried out. The opening 17 formed in the top substrate is formed by turns in parallel with the opening 27 formed in the bottom substrate. The perpendicular orientation film 14 is formed on the common electrode 13 also at the top substrate 100.
[0121] Between two substrates, the liquid crystal matter which has the dielectric constant anisotropy of shade is poured in, and orientation of the liquid crystal molecule is perpendicularly carried out by the orientation force of the perpendicular orientation films 14 and 24 currently formed in two substrates 100,200 to two substrates 100,200.
[0122] Unlike the 10th example of this invention, a gate line can also cover the portion in which it forms in like the usual method and the opening pattern for the division orientation of a underplate is formed using a black matrix. Drawing 26 is the plan of the liquid crystal display by the 11th example of this invention.
[0123] The black matrix 11 has covered the portion in which the outside of a pixel and the opening 17 of a finish plate are formed, and the portion which a texture generates like the 10th example of this invention shown in drawing 23 , and it is formed so that it can cover to the portion in which the opening 27 of a underplate is formed unlike the 10th example.
[0124] A wrap case, it is not necessary to take into consideration the influence according the portion in which opening is formed like the 11th example of this invention using a black matrix, and the portion which a texture generates to change of a gate line pattern, the angle of visibility of a perpendicular orientation liquid crystal display can be made large at a process having no additional process and simple, and brightness can be raised.
[0125] In addition, instead of forming opening, the gestalt of a pixel electrode can be changed and a texture can also be removed.
[0126] As mentioned above, although the portion which a texture generates is a portion which opening of a TFT

substrate and the boundary of a pixel electrode collide with, since the boundary of a pixel electrode is essentially similar with opening of a TFT substrate, this portion is a portion to which that the angle of the portion by which opening was bent makes an obtuse angle breaks the 1st condition of being good. That is, it becomes the cause which the array of a liquid crystal molecule confused when the electric field impressed to a liquid crystal layer changed, while the angle which an opening pattern and the boundary of a pixel electrode make turned into an acute angle, the array of a liquid crystal molecule was confused in this portion and the fall of brightness occurred moves, and induces an after-image.

[0127] Therefore, it is made for the angle which changes the gestalt of the pixel electrode 21 in the portion which the boundary of the pixel electrode 21 and the opening 27 currently formed in the pixel electrode collide with, and the boundary and opening 27 of the pixel electrode 21 make to become 90 degrees or more in the 12th example of this invention. As shown to drawing 27 by this, the gestalt of the pixel electrode 21 turns into a gestalt projected to the tooth form of a saw between the opening 27 formed in the pixel electrode, and the opening 17 formed in the common electrode.

[0128] In the 13th example of this invention, the gestalt of a pixel electrode is formed in the tooth form of a saw in accordance with the gestalt of opening. Drawing 28 is the plan of the liquid crystal display by the 13th example of this invention which formed the pixel electrode in the tooth form of a saw in this way.

[0129] If the pixel electrode 22 is formed in the gestalt surrounding openings 17 and 27 at the tooth form of a saw like the liquid crystal display by the 13th example of this invention shown in drawing 28 , since the portion which openings 17 and 27 and the boundary of the pixel electrode 22 collide with will be lost, the problem of the texture by this etc. is not generated.

[0130] Width of face, an interval, etc. of opening in the 12th and 13th examples of this invention are similar with the above-mentioned example.

[0131] Although what forms an opening pattern in both a common electrode and a pixel electrode was explained above, the method of forming a salient with an opening pattern can also be used for a pixel electrode instead of forming an opening pattern in a common electrode. In this case, a salient is formed by the gate insulator layer or the protective coat. When forming a salient, it must be cautious of parasitism electrostatic capacity being formed between wiring. At this time, arrangement of an opening pattern and a salient is made to be the same as that of drawing 21 .

[0132] Moreover, as other methods, an opening pattern is formed in a pixel electrode and there is the method of forming a salient in a common electrode. Also in this case, arrangement of an opening pattern and a salient is made to be the same as that of drawing 21 .

[0133]

[Effect of the Invention] According to this invention, an angle of visibility is large, the orientation of a liquid crystal molecule is stable, and a speed of response can obtain a quick liquid crystal display.

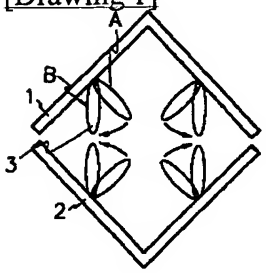
[Translation done.]

* NOTICES *

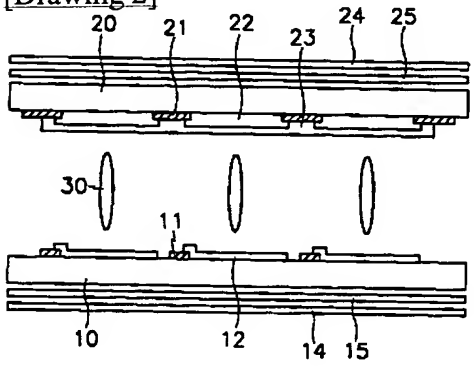
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]

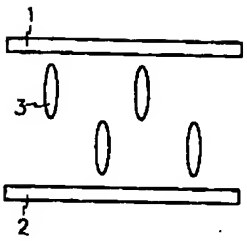


[Drawing 2]

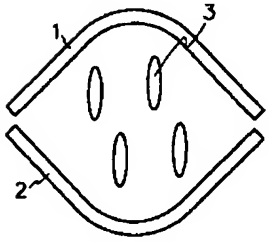


[Drawing 3]

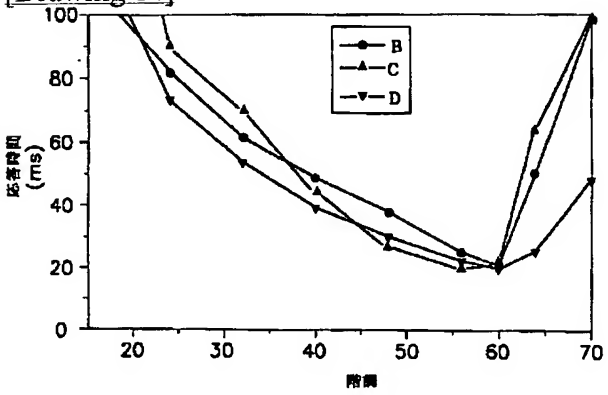
A



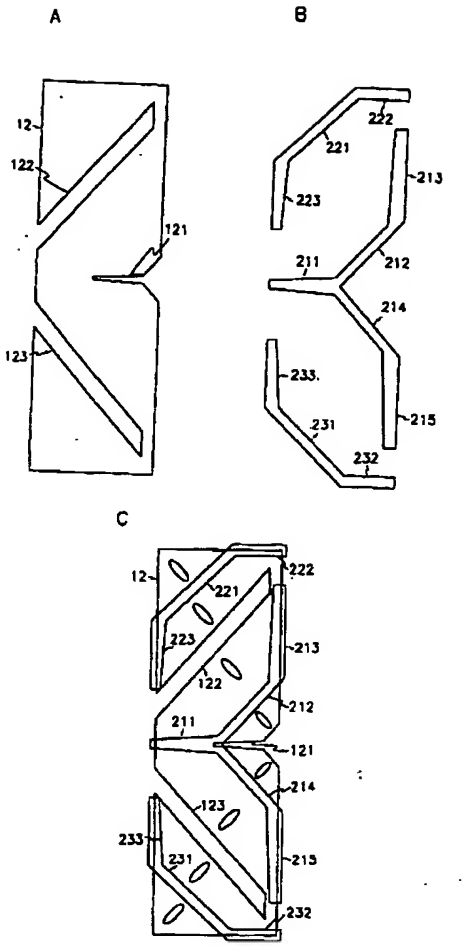
B



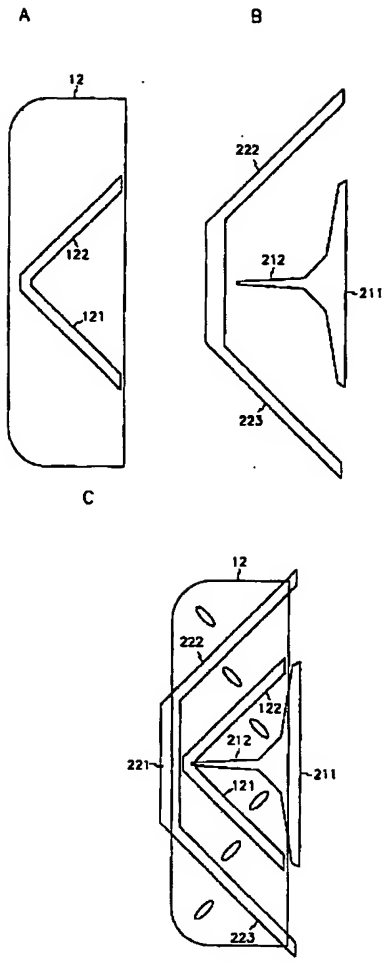
[Drawing 14]



[Drawing 4]


A
B
12
122
121
123
222
221
213
223
211
212
214
233
231
215
232
C
12
221
222
223
213
122
212
211
121
214
123
233
231
215
232

[Drawing 5]



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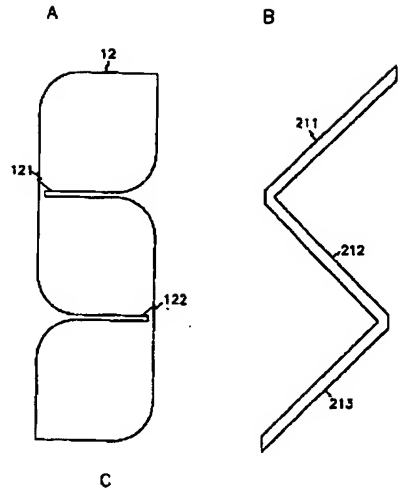
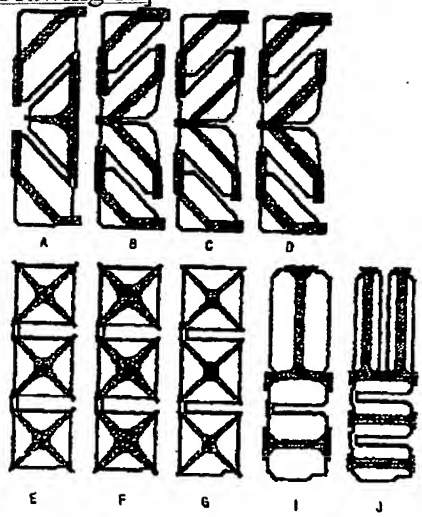
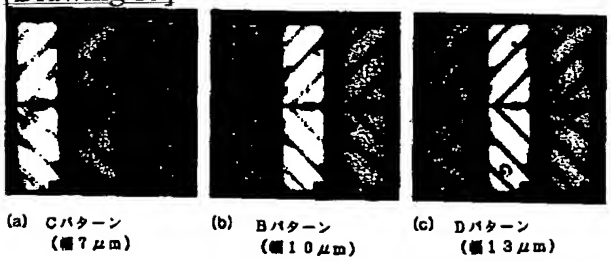


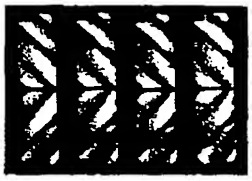
[Drawing 11]



[Drawing 15]



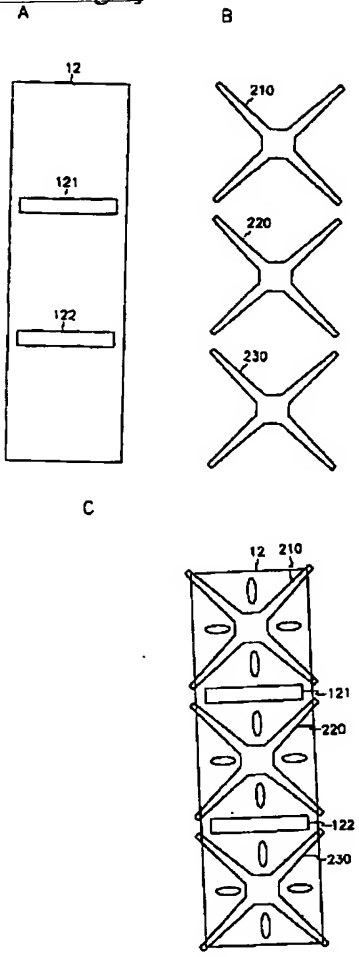
[Drawing 16]



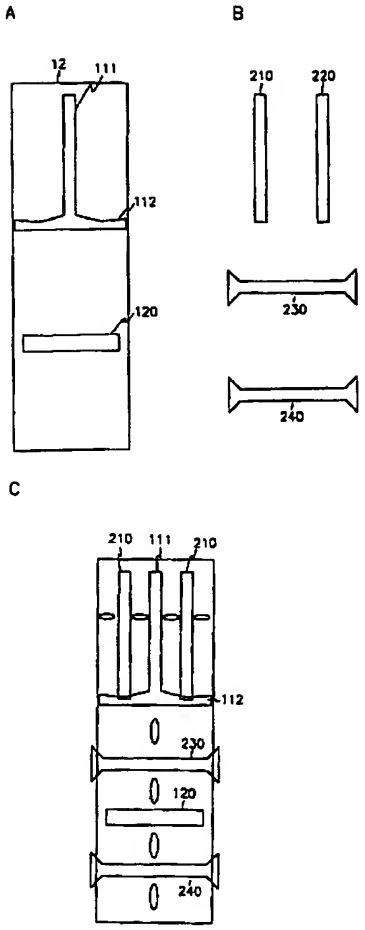
(a) Cパターン
9V→3．5V→4V→5V

(b) Dパターン
9V→3．5V→4V→5V

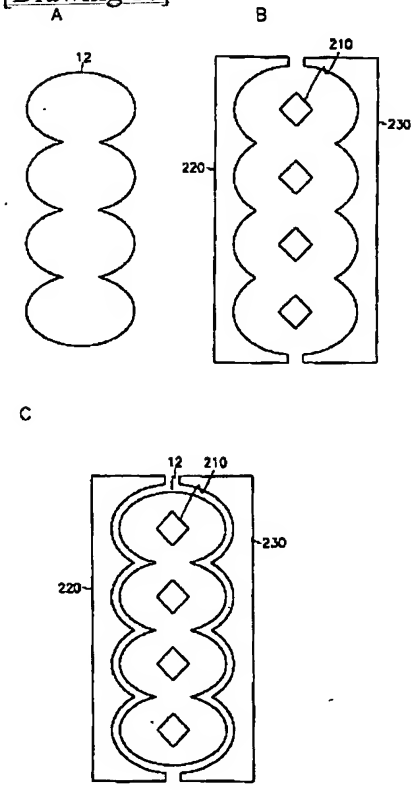
[Drawing 7]



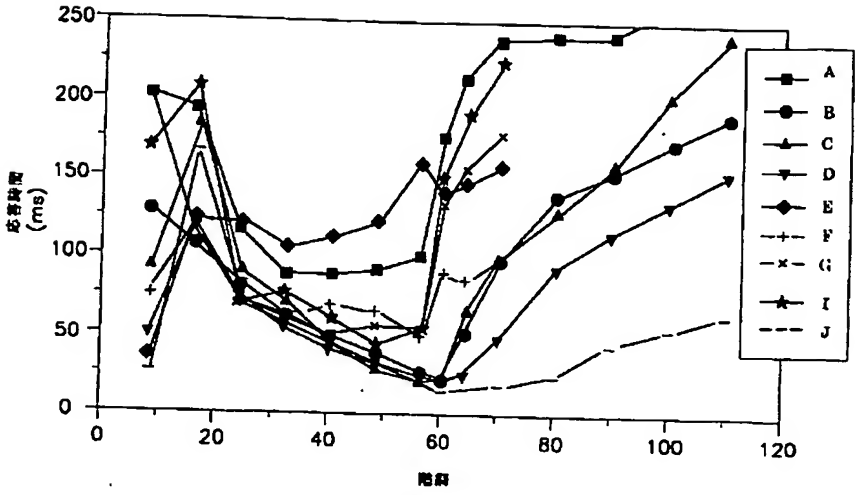
[Drawing 8]



[Drawing 10]

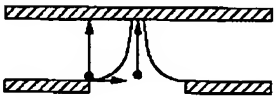


[Drawing 13]

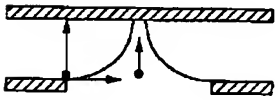


[Drawing 17]

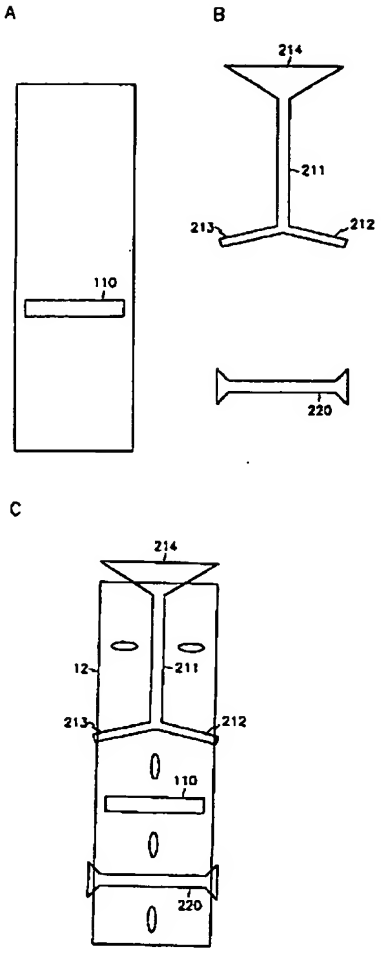
A



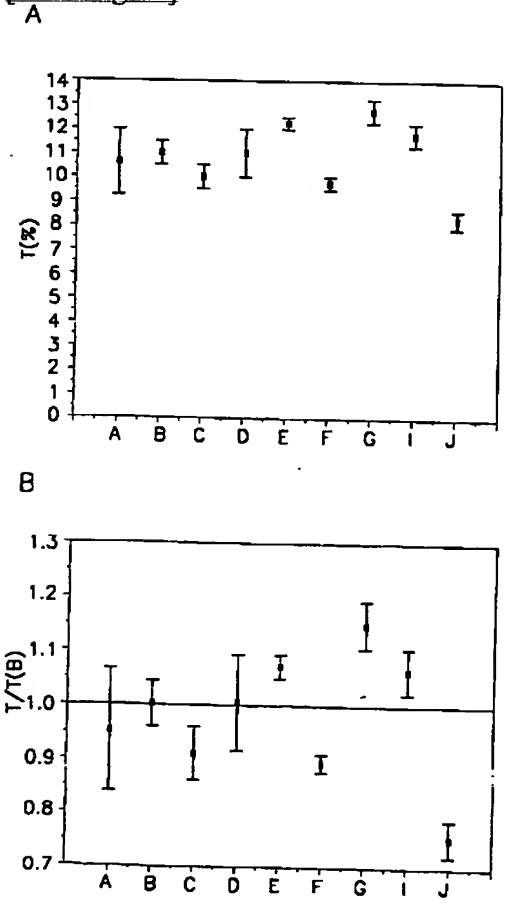
B



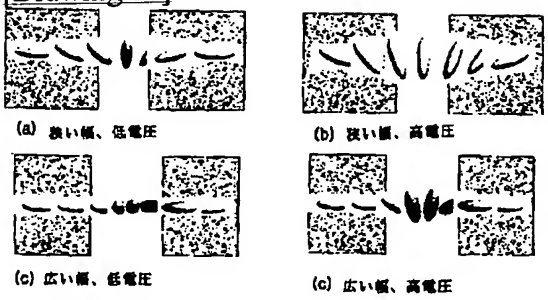
[Drawing 9]


A
B
214
211
213
212
110
220
C
214
12
211
213
212
110
220

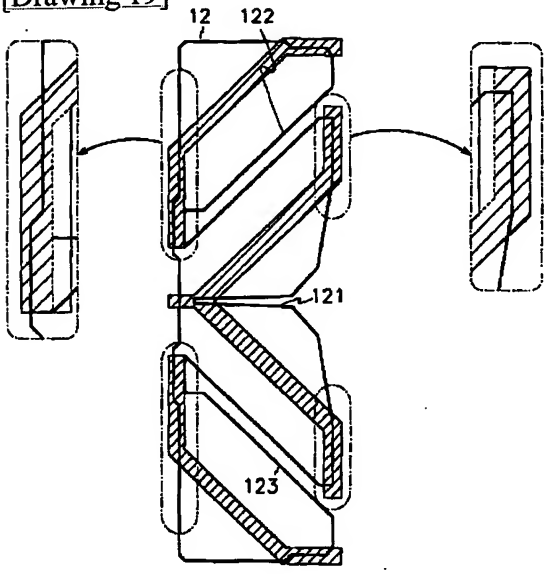
[Drawing 12]


A
T(%)
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
A B C D E F G I J
B
T/T(B)
1.3
1.2
1.1
1.0
0.9
0.8
0.7
A B C D E F G I J

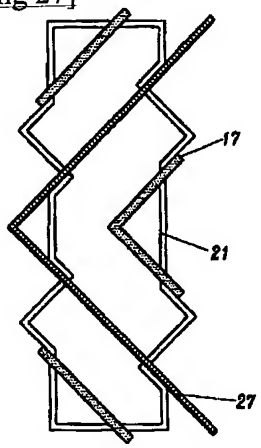
[Drawing 18]



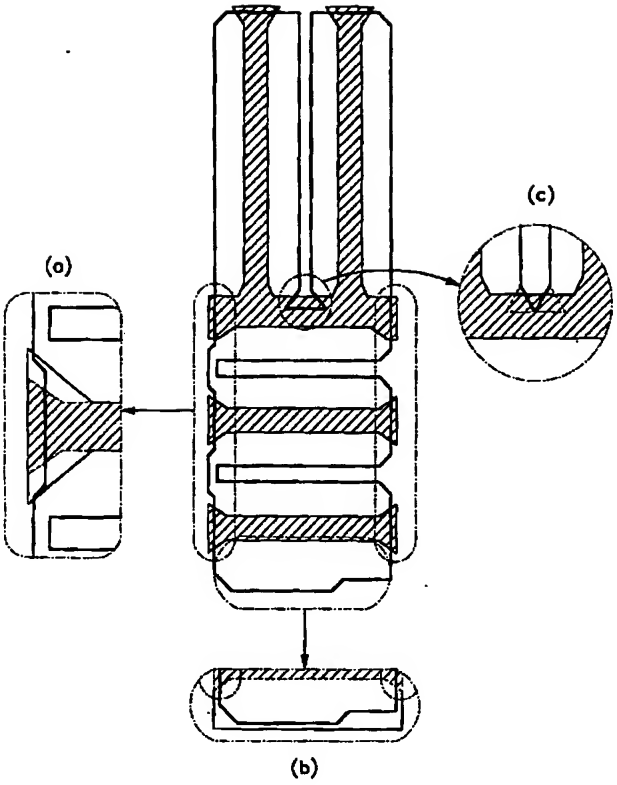
[Drawing 19]



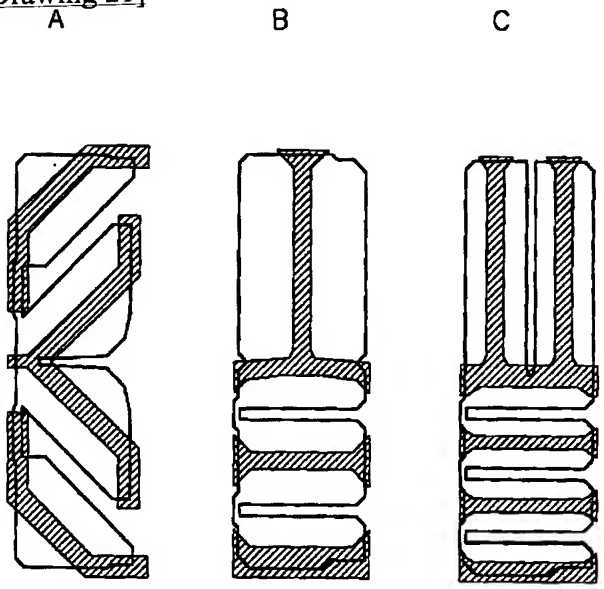
[Drawing 27]



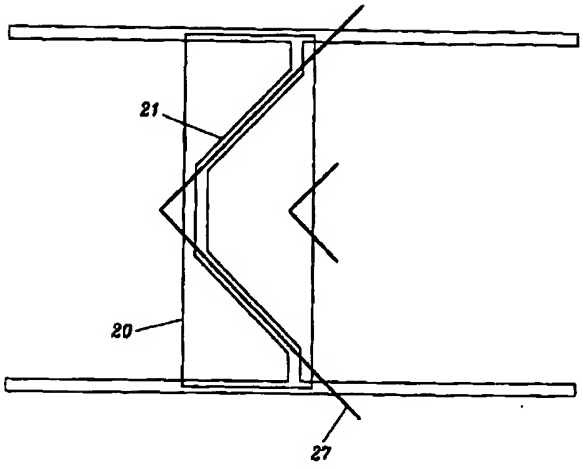
[Drawing 20]



[Drawing 21]



[Drawing 22]



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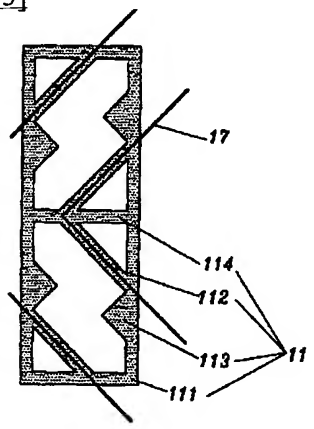

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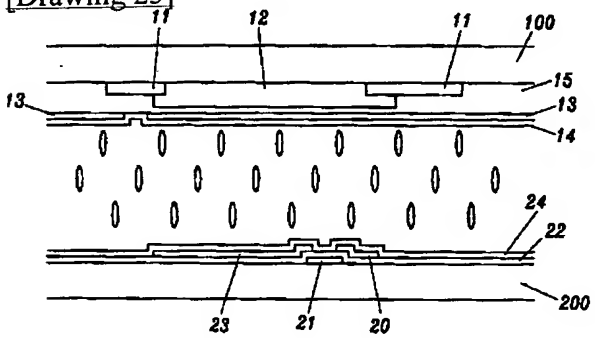

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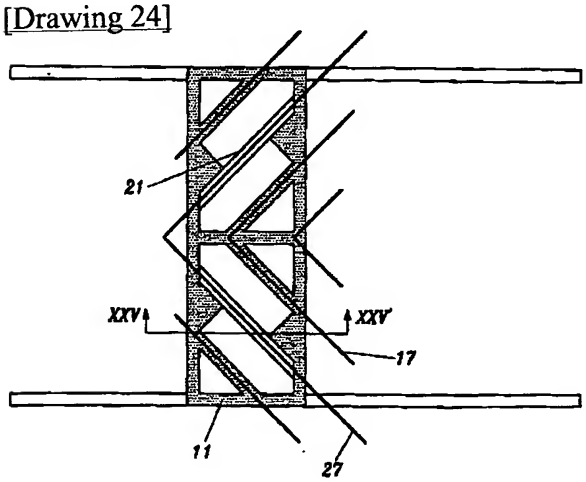
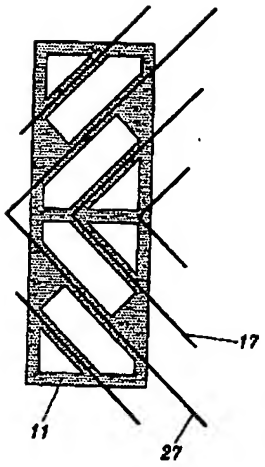
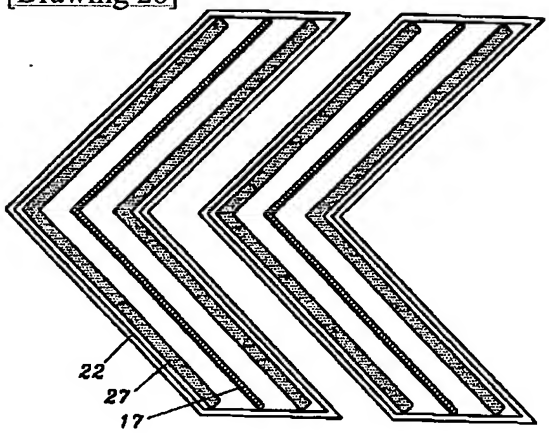


[Drawing 26]



[Drawing 28]



[Translation done.]